DOCUMENT RESUME

ED 365 534 SE 053 966

AUTHOR Kemis, Mari R.; And Others
TITLE Superintendents' and Teachers' Knowledge of Curriculum Reform Efforts in Mathematics and Science: Does School Size Make a Difference?
INSTITUTION Iowa State Univ. of Science and Technology, Ames. Research Inst. for Studies in Education.
PUB DATE 4 Dec 92
NOTE 38p.; Paper presented at the Annual Conference of the Iowa Educational Research and Evaluation Association (Ames, IA, December 4, 1992).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Curriculum Development; Educational Change; Elementary School Teachers; Elementary Secondary Education; *Knowledge Level; Mathematics Curriculum; Mathematics Education; Mathematics Instruction; *Mathematics Teachers; *School Size; School Surveys; Science Curriculum; Science Education; *Science Teachers; Secondary School Teachers; *Superintendents; Tables (Data)
IDENTIFIERS *Iowa; National Standards; NCTM Curriculum and Evaluation Standards; Project 2061 (AAAS); *Reform Efforts

ABSTRACT

This study examined whether there were significant differences in the level of knowledge regarding curriculum reform efforts in mathematics and science and the level of incorporation of these new standards and recommendations into the curriculum among districts of varying size in Iowa. Data were gathered from respondents to school surveys of randomly selected superintendents (n=130) and teachers (165 mathematics and 140 science secondary teachers, and 173 K-8 teachers) about the needs of Iowa's mathematics and science teachers, the supply and demand for qualified mathematics and science teachers, and curricular needs in mathematics and science. Data analysis indicated that: (1) all groups reported little familiarity with reform efforts regardless of the size of the school district; (2) superintendents were somewhat more familiar with the reform efforts than are teachers of both science and mathematics; (3) knowledge of reform efforts in mathematics was slightly higher than for science; (4) teachers of mathematics and science were more likely to know about reform at their own grade level; and (5) there were no significant differences between either teacher or superintendent groups from different size districts in knowledge about mathematics and science reform efforts. The study concluded that there was the need to provide educational opportunities to inform superintendents and teachers of the reform efforts. (MDH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 365 534

Superintendents' and Teachers' Knowledge of Curriculum Reform Efforts in Mathematics and Science: Does School Size Make a Difference?

by

Mari R. Kemis
Jan Sweeney
Christine K. Sorensen
Mary J. Lively

Research Institute for Studies in Education
College of Education
Iowa State University
Ames, Iowa 50011

Paper Presented at the Annual Conference of the
Iowa Educational Research and Evaluation Association

December 4, 1992
Ames, Iowa

PERMISSION TO REPRODUCE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY

Christine K. Sorensen

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

BEST COPY AVAILABLE

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Superintendents' and Teachers' Knowledge of Curriculum Reform Efforts in Mathematics and Science: Does School Size Make a Difference?

BACKGROUND

In April 1992, Iowa State University's Research Institute for Studies in Education (RISE) conducted a needs assessment of elementary and secondary curriculum needs and the supply and demand for teachers in mathematics and science in Iowa. The study, which was sponsored by the Iowa Department of Education and the Iowa State Board of Regents, was conducted to meet informational requirement mandates for the Dwight D. Eisenhower Mathematics and Science Education Grant Programs. Data were gathered from Iowa school superintendents and teachers about the needs of Iowa's current teachers in mathematics and science, the supply and demand for qualified teachers in mathematics and science, and curricular needs in mathematics and science. Information was compiled on curriculum structure and revision and familiarity of teachers and superintendents with current reform efforts in mathematics and science.[1]

PURPOSE

The purpose of the analysis presented in this paper is to determine whether there are significant differences in the level of knowledge regarding curriculum reform efforts in mathematics and science and the level of incorporation of these new standards and recommendations into the curriculum among districts of varying size. Superintendents and mathematics and science teachers from across the state were surveyed. Comparisons were made to determine whether there were significant differences in several areas: district curriculum structures for mathematics and science, policies regarding adherence to district curriculum, familiarity with current reform efforts in mathematics and science, revisions of mathematics and science curricula,

---

[1] Sweeney, Jan, Mari R. Kemis, Mandi Lively, and Chris Sorensen (1992). *An assessment of elementary and secondary curriculum needs and supply and demand for teachers in mathematics and science in Iowa.* Ames, IA: Research Institute for Studies in Education.

the use of new standards and recommendations in the revisions, and perceptions of teachers about their preparedness to implement new curricula.

METHODOLOGY

A description of the sample and survey instruments used in conducting the needs assessment is presented below.

Sample

Stratified random samples of local school superintendents, and K-8 and secondary mathematics and science teachers were surveyed by mail. Using a list provided by the Iowa Department of Education, the Statistical Laboratory at Iowa State University randomly selected 197 superintendents, 250 secondary mathematics teachers, 250 secondary science teachers, and 300 kindergarten through 8th grade teachers, controlling for geographical representation. Information describing the sample and return rates is presented in Table 1.

TABLE 1
Sample size and return rates for groups surveyed

Group	Sample Size	Number of Respondents	Percent Returned
Superintendents	197	130	66.0
Secondary Mathematics Teachers	250	165	66.0
Secondary Science Teachers	250	140	56.0
K-8 Teachers	300	173	57.7
Total	997	608	61.0

Survey Instruments

Two survey instruments designed by RISE were used in the needs assessment. Both superintendent and teacher surveys included questions about curriculum structure and revision. The teacher surveys included additional questions related to overall preparation of teachers of mathematics and science.

Standards and Recommendations Cited in the Surveys

The study examined how mathematics and science curricula in Iowa are related to current reform movements in these two areas. *The Curriculum and Evaluation Standards for School Mathematics*, published by the National Council of Teachers of Mathematics (NCTM), was specified as the mathematics reform effort. The NCTM standards were published in March, 1989, to give direction toward a set of national expectations while allowing and encouraging local initiatives. They were developed by the Commission on Standards for School Mathematics, in collaboration with its working groups, teachers, administrators, and lay people. They include 40 curriculum standards that pertain to three grade-level groups: kindergarten through 4th, 5th through 8th, and 9th through 12th. There are also 14 evaluation standards. These criteria provide a means of judging the quality of the mathematics curriculum.

Recommendations from two reform efforts in science were referenced in the survey. The first was the American Association for the Advancement of Science (AAAS) *Project 2061: Science for All Americans*. Initiated in 1989, Project 2061 is a long-term multiphasic undertaking designed to address scientific literacy as a national goal and to help reform science, mathematics, and technology education in the United States. Leading scientists and educators identified knowledge and skills deemed essential to improve science education. The second was *The Project on Scope, Sequence, and Coordination of Secondary School Science* (SS&C) initiated by the National Science Teachers Association (NSTA). It is a major reform effort to restructure science teaching at the secondary level. The NSTA plan calls for eliminating the tracking of students, recommends that all students study science every year for six years, and advocates the study of science as carefully sequenced, well-coordinated instruction in physics, chemistry, biology, and earth/space science.

RESULTS

Results of statistical analyses are presented in the next section. First, a description of the samples is provided. Second, results of comparisons of curriculum structure and adherence to district policy among different size school districts are presented. Third, knowledge of reform

efforts among teachers and superintendents in different size school districts is compared. Fourth, most recent curriculum revisions in mathematics and science and the incorporation of new standards and recommendations are studied. Fifth, teacher perceptions of how prepared they are to implement new curricula are provided.

Description of Respondents

One hundred thirty Iowa superintendents responded to the needs assessment survey. Slightly less than 20 percent were from districts with student enrollments of under 400. Over 50 percent were employed in districts with enrollments between 400 and 1000 students. Twenty percent had enrollments of 1000 to 2500 students in their district, and approximately nine percent had district enrollments of more than 2500 students (Table 2).

TABLE 2
Size of district as reported by superintendents

K-12 Enrollment	Number	Percent
Less than 400	24	18.7
400 - 599	30	23.4
600 - 999	37	28.9
1000 - 2499	26	20.3
2500 or more	11	8.6
Not specified	2	****

Characteristics of the teacher respondents are presented in Table 3. Of the 800 teachers surveyed, 478 responded. Among those responding, 31 percent classified themselves as elementary teachers, eight percent were middle school/junior high teachers, and 50 percent were high school teachers. About 10 percent indicated that they taught both middle school and high school and less than one percent taught both elementary and middle school. Districts with enrollments of over 2500 employed more middle school/junior high teachers, while in smaller districts, more teachers taught at both the middle and high school levels.

TABLE 3
Characteristics of teacher respondents

Characteristic	Percent of Respondents
Teaching Level	
Elementary	31.4
Middle School/Junior High	7.8
High School	50.1
Elementary and Middle School	0.2
Middle and High School	10.5
Subject Matter	
Mathematics	37.5
Science	29.7
Mathematics and Science	32.8
Years of Teaching Experience	
10 and under	26.0
11 to 20	33.0
Over 20	41.0
Gender	
Male	49.6
Female	50.4

Among those responding to the survey, about 37 percent were mathematics teachers, nearly 30 percent were science teachers, and about one-third taught both mathematics and science. Over 40 percent of the teachers had been in the classroom for over 20 years. One-third had 11 to 20 years of teaching experience, and slightly over one-fourth had under ten years of experience. Males and females were almost equally represented.

Curriculum Structure and Policy

Superintendents were asked to indicate whether mathematics and science were departmentalized at the elementary level in their districts. Comparisons by district size were made using chi-square analysis. Superintendent responses revealed differences between the districts in the structure of the mathematics and science departments. Districts with enrollments of over 1000 were more likely to have departmentalized elementary mathematics, while districts with enrollments of over 2500 were more likely to have departmentalized elementary science. Districts

with enrollments in the 600-999 range reported more frequently than expected that science and mathematics were not departmentalized at the elementary level. These results are shown in Table 4.

Both superintendents and teachers were asked to indicate district policy concerning adherence to district mathematics and science curricula. Chi-square analysis was used to examine differences in responses of the two groups by district size. The results are presented in Table 5.

Superintendents in the smaller districts were more likely to report that adherence to the district mathematics and science curricula by individual teachers was suggested as opposed to required. Superintendents in districts with 1000-2500 pupils were more likely than expected to report requiring teachers to adhere to the district science curriculum. No superintendents reported that adherence to district policy was voluntary.

Overall, there were few significant differences in perceptions of policy found among the teachers of mathematics from different size school districts. Teachers in the largest school districts (over 2500) were more likely to indicate that adherence to the district mathematics curriculum by individual teachers is required rather than suggested or voluntary. Fewer teachers than expected in districts under 400 and districts of 600-999 enrollments indicated that adherence to the district mathematics curriculum was required. There were no significant differences based on district size when comparing policies related to adherence to the district science curriculum.

Knowledge of Mathematics and Science Curriculum Reform Efforts

Superintendents and teachers were asked to report knowledge about curriculum reform efforts in mathematics and science. One-way analysis of variance was used to compare the responses of superintendents and teachers by district size. Few differences were found in the level of knowledge about curriculum reform efforts in mathematics and science among superintendents from districts of different sizes. One significant difference was found in the level of knowledge of science recommendations at the elementary level. Superintendents in

TABLE 4
Superintendent responses regarding departmentalization of curriculum by school district enrollment

Item		<400		400-599		600-999		1000-2500		>2500		Total		X^2	Prob.
		n	%	n	%	n	%	n	%	n	%	n	%		
Mathematics is departmentalized at the elementary level	Yes	10	13.9	18	25.0	13	18.1[b]	21	29.2[a]	10	13.9[a]	72	58.1		
	No	12	23.1	11	21.2	23	44.2[a]	5	9.6[b]	1	1.9[b]	52	41.9	19.13	0.001
Science is departmentalized at the elementary level	Yes	14	20.3	15	21.7	13	18.8[b]	17	24.6	10	14.5[a]	69	55.2		
	No	9	16.1	14	25.0	23	41.1[a]	9	16.1	1	1.8[b]	56	44.8	12.51	0.014

[a] More than expected
[b] Fewer than expected

TABLE 5

Policy regarding adherence to district curriculum by individual teachers as reported by superintendents and teachers

Item	<400 n	<400 %	400-599 n	400-599 %	600-999 n	600-999 %	1000-2500 n	1000-2500 %	>2500 n	>2500 %	Total n	Total %	X^2	Prob.
Superintendents														
District policy about adherence to math curriculum by individual teachers														
Required	7	9.9[b]	19	26.8	17	23.9	19	26.8	9	12.7	71	56.8		
Suggested	16	29.6[a]	10	18.5	19	35.2	7	13.0	2	3.7	54	43.2	14.37	0.006
District policy about adherence to science curriculum by individual teachers														
Required	6	9.2[b]	17	26.2	17	26.2	18	27.7[a]	7	10.8	65	50.8		
Suggested	18	28.6[a]	13	20.6	20	31.7	8	12.7[b]	4	6.3	63	49.2	11.41	0.022
Teachers														
District policy about adherence to math curriculum by individual teachers														
Required	9	6.5[b]	16	11.5	14	10.1[b]	33	23.7	67	48.2[a]	139	42.9		
Suggested	19	12.5	23	15.1	30	19.7	36	23.7	44	28.9[b]	152	46.9		
Voluntary	6	18.2	6	18.2	8	24.2	8	24.2	5	15.2[b]	33	10.2	23.41	0.003
District policy about adherence to science curriculum by individual teachers														
Required	5	4.8	11	10.6	19	18.3	24	23.1	45	43.3	104	36.2		
Suggested	14	9.5	26	17.7	26	17.7	27	18.4	54	36.7	147	51.2		
Voluntary	5	13.9	7	19.4	10	27.8	8	22.2	6	16.7	36	12.5	13.08	0.109

[a] More than expected

[b] Fewer than expected

schools with enrollments of over 2500 rated themselves significantly more familiar with them (2.91) than did superintendents in other size districts.

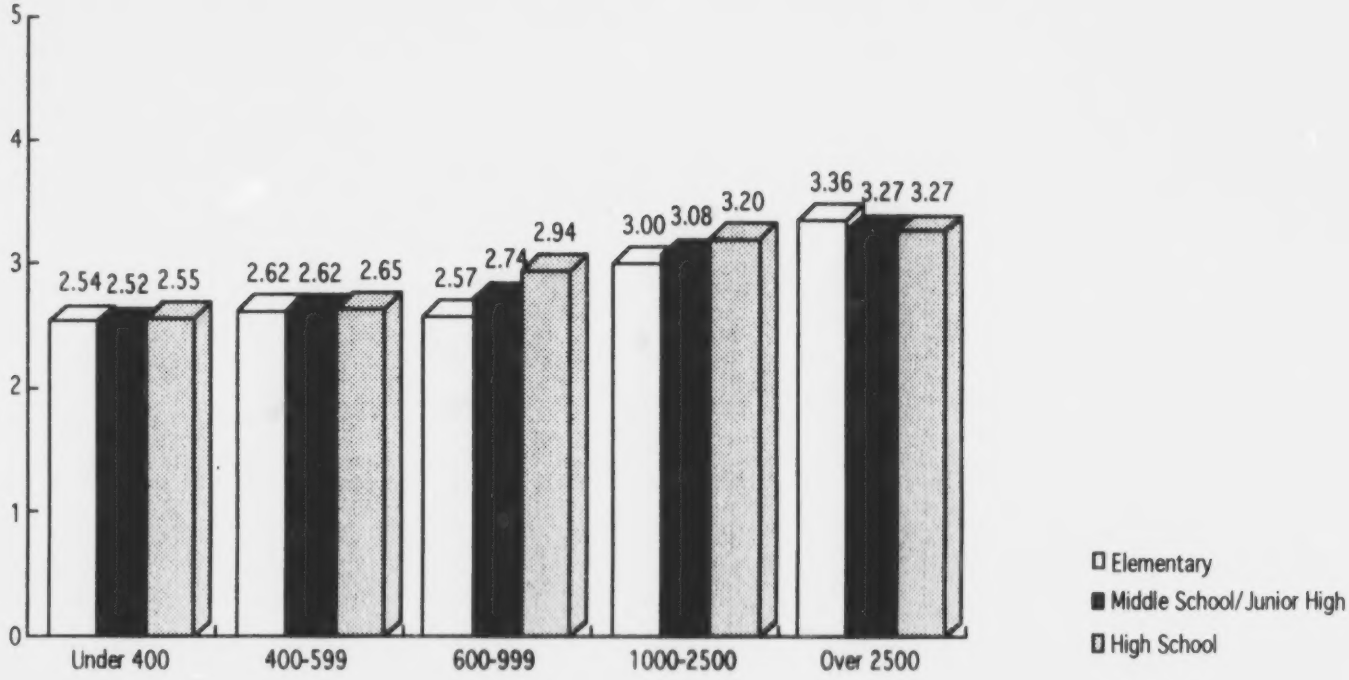
The fact that there was little difference in the level of superintendent knowledge about curriculum reform efforts among school districts of different sizes was, however, not entirely positive. No group of superintendents rated themselves as "very familiar" or "completely familiar" with the NCTM standards or AAAS and NSTA recommendations. Knowledge of the mathematics reform efforts were generally in the range of "know a little" to "fairly familiar," while average ratings of knowledge of science reform efforts were slightly lower. The means for the groups can be seen in Figures 1 and 2.

In comparisons of superintendent knowledge of mathematics curriculum reform efforts at all three grade levels, the largest districts (over 2500) had the highest average mean, while the smallest districts (under 400) had the lowest average mean; however, these differences were not statistically significant. In the comparisons of knowledge of science reform, the largest districts (over 2500) again had the highest means, with the lowest means in districts of 400-599 students.

There were no significant differences in the level of knowledge about curriculum reform efforts among teachers of mathematics and science from different size school districts. Generally, teachers rated their knowledge of standards for their own grade slightly higher than their knowledge for other grades. Ratings for knowledge of mathematics reform efforts were also slightly higher than ratings for science reform. However, the highest rating in any area was 3.05 on a five-point scale (Figures 3 and 4). The highest rating was for mathematics teachers' knowledge of NCTM standards in their own grade. Knowledge of science recommendations by science teachers for their own grade had very low ratings in the range of 1.81 to 2.04, with average ratings for knowledge of science recommendations for other grades failing to reach even 2.00 on the five-point scale.

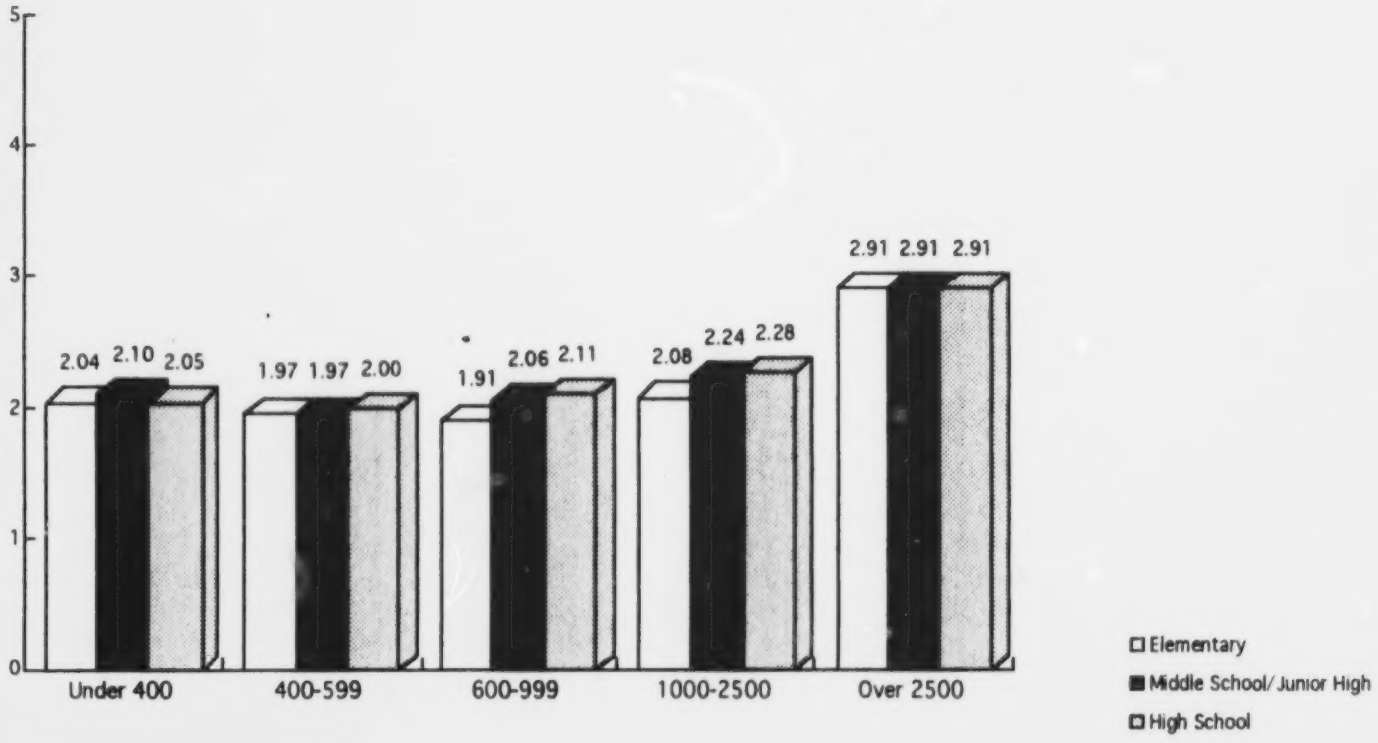
Teachers of mathematics in districts of 1000-2500 students had the highest average on knowledge of mathematics reform efforts for their own grade (3.05), and teachers in the smallest schools (under 400) had the highest rating for knowledge of NCTM standards for all grades

Figure 1. Knowledge of NCTM standards as reported by superintendents from different size school districts



Scale: 1= don't know 2= know little 3= fairly familiar 4= very familiar 5= completely familiar

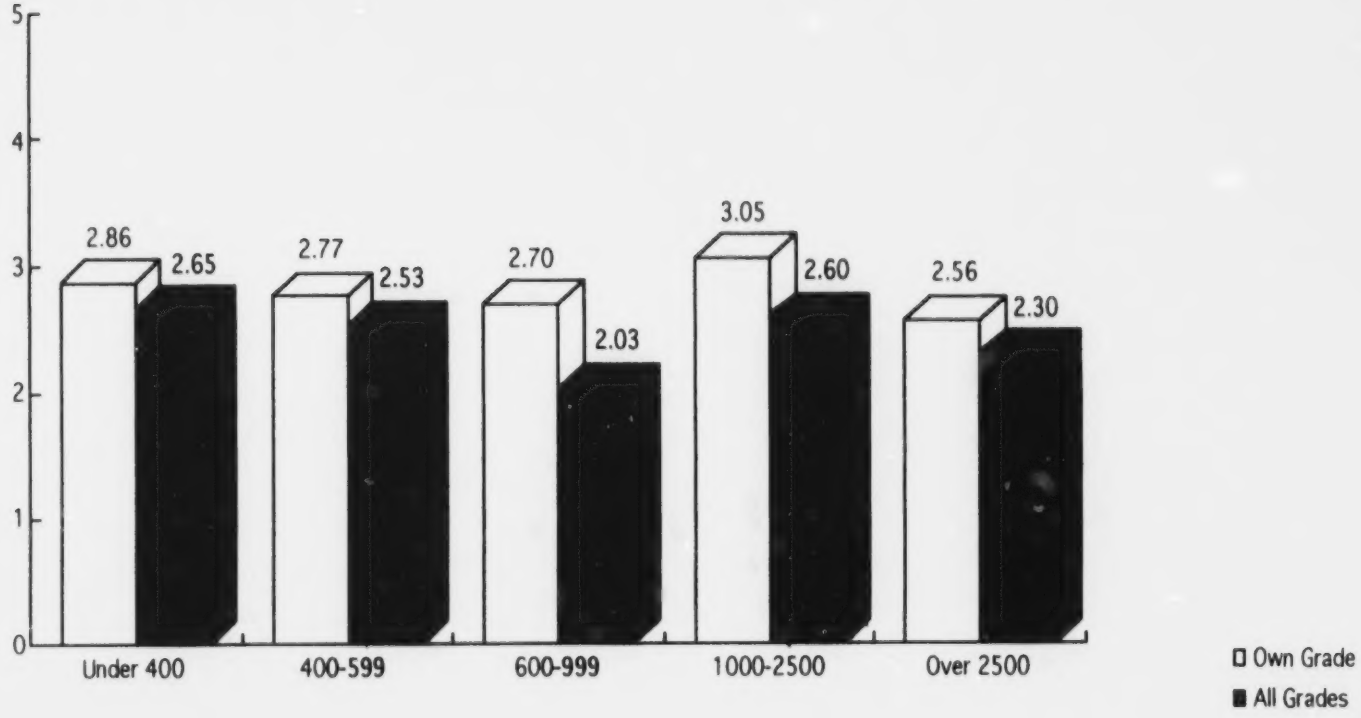
Figure 2. Knowledge of AAAS/NSTA science recommendations as reported by superintendents from different size school districts



Scale: 1= don't know 2= know little 3= fairly familiar 4= very familiar 5= completely familiar

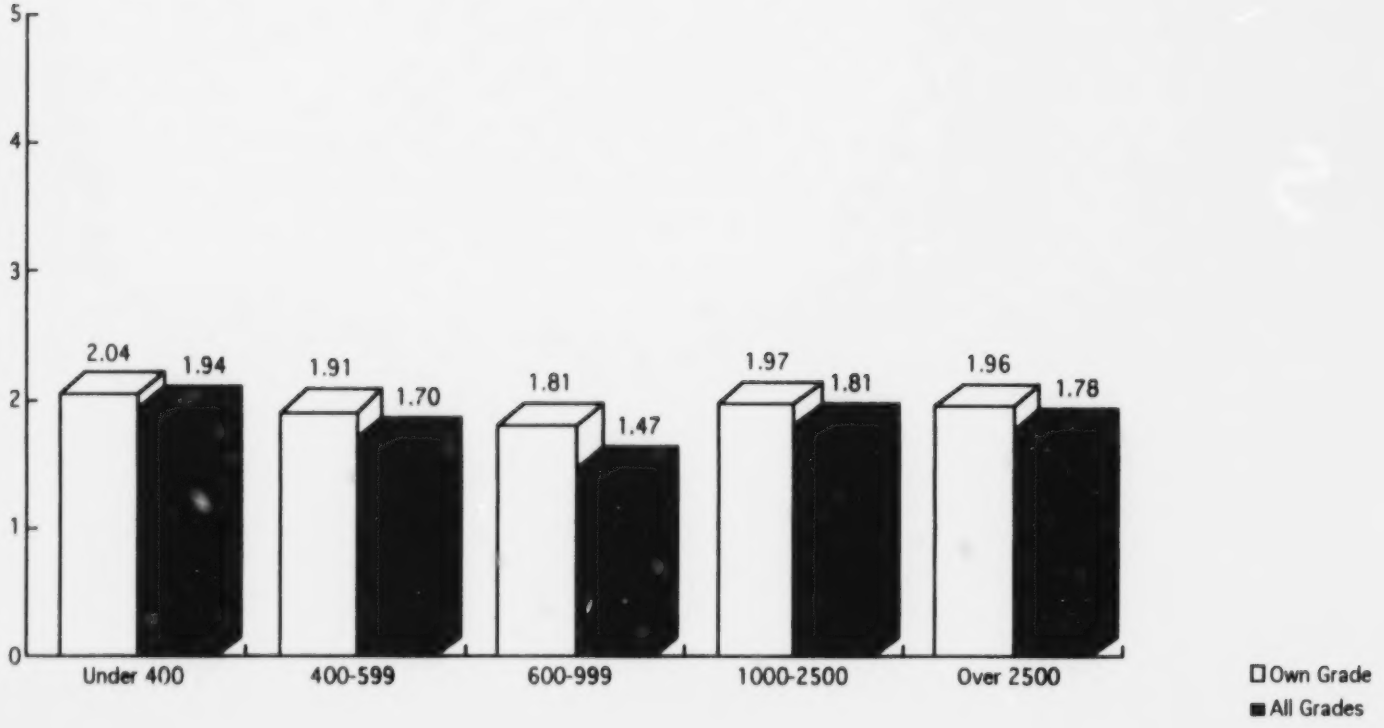
Note: Significant difference in knowledge of science recommendations at elementary level ($p<0.05$).

Figure 3. Knowledge of NCTM standards as reported by mathematics teachers in different size school districts



Scale: 1= don't know 2= know little 3= fairly familiar 4= very familiar 5= completely familiar

Figure 4. Knowledge of AAAS/NSTA science recommendations as reported by science teachers in different size school districts



Scale: 1= don't know 2= know little 3= fairly familiar 4= very familiar 5= completely familiar

(2.65). Teachers in schools of 600-999 students had the lowest average rating for knowledge of NCTM standards for all grade levels, but teachers in the largest schools (over 2500) had the lowest average rating for knowledge of NCTM standards at their own grade level (2.56).

Teachers of science in the smallest schools (under 400) rated themselves as a group the highest in knowledge of science reform for both their own grade level as well as all grade levels (2.04 and 1.94). Teachers in districts of 600-999 students had the lowest mean rating for knowledge of science reform efforts at their own grade level and at all grade levels (1.81 and 1.47).

Revision of Mathematics and Science Curricula

A majority of the superintendents reported that mathematics and science curriculum revisions have occurred in their districts since 1989. Between two-thirds and three-fourths indicated that the last curriculum revision had occurred since 1989, while one-fourth to one-third indicated that the last revision had occurred prior to 1989. A small percentage described curriculum reform as an on-going process (Table 6).

Overall, about 30 percent of the superintendents reported plans to revise the mathematics curriculum in one to two years, approximately 40 percent in three to four years, and 33 percent in five or more years. Thirty percent of the superintendents reported plans to revise the science

TABLE 6
Superintendents' report of last district curriculum revisions in mathematics and science

Item	% before 1989	% since 1989	% ongoing
Last elementary mathematics revision	28.0	70.3	1.7
Last middle school mathematics revision	25.0	74.1	0.9
Last high school mathematics revision	25.9	70.5	3.6
Last elementary science revision	32.5	65.8	1.8
Last middle school science revision	31.0	68.1	0.9
Last high school science revision	27.7	69.6	2.7

curriculum in one to two years, 35 percent in three to four years, and 35 percent in five or more years (Table 7).

NCTM standards and science recommendations from AAAS and NSTA have been available since 1989. Among superintendents reporting that district curriculum revisions in mathematics and science had occurred since 1989, frequency distributions were used to determine the extent that national curriculum reform recommendations were used in the revisions. These results are presented in Tables 8 and 9.

Superintendents in the largest school districts (over 2500) were more likely than those from the other district groups to report extensive use of the NCTM standards in mathematics curriculum revision. The two smallest district groups (under 400 and 400-599) had larger percentages of superintendents reporting that they did not know whether NCTM standards had been used. Nearly an equal percentage of superintendents in the larger districts (600-999, 1000-2500, and over 2500) reported extensive use of the AAAS and NSTA recommendations in science curriculum revisions since 1989. None of the superintendents in the smallest districts (under 400 and 400-599) reported extensive use of the recommendations.

TABLE 7
Superintendents' reports of plans for next revision of mathematics and science curricula

Item	1-2 years	3-4 years	5+ years
Next elementary mathematics revision	32.0	36.9	31.1
Next middle school mathematics revision	25.6	41.0	33.3
Next high school mathematics revision	27.6	38.8	33.6
Next elementary science revision	31.4	35.5	33.1
Next middle school science revision	29.3	34.5	36.2
Next high school science revision	30.2	35.3	35.4

TABLE 8

Use of NCTM standards in school districts of various size that have revised their mathematics curriculum since 1989 as reported by superintendents

	Under 400		400-599		600-999		1000-2500		Over 2500	
Extent Used	N	%	N	%	N	%	N	%	N	%
Elementary										
Extensively	2	14.3	2	10.0	3	14.3	5	29.4	5	55.6
Somewhat	1	50.0	5	25.0	11	52.4	8	47.1	3	33.3
A little	1	7.1	4	20.0	4	19.0	2	11.8	0	0.0
Not used	2	14.3	3	15.0	1	4.8	0	0.0	0	0.0
Don't know	2	14.3	4	20.0	2	9.5	2	11.8	1	11.1
Used other	0	0.0	2	10.0	0	0.0	0	0.0	0	0.0
Middle/Junior High										
Extensively	4	12.5	1	5.0	3	15.8	6	37.5	6	60.0
Somewhat	7	43.8	6	30.0	10	52.6	7	43.8	3	30.0
A little	1	6.3	5	25.0	4	21.1	2	12.5	1	10.0
Not used	4	25.0	3	15.0	0	0.0	0	0.0	0	0.0
Don't know	2	12.5	3	15.0	2	10.5	1	6.3	0	0.0
Used other	0	0.0	2	10.0	0	0.0	0	0.0	0	0.0
High School										
Extensively	1	7.7	2	10.0	3	15.8	6	35.3	5	62.5
Somewhat	6	46.2	5	25.0	10	52.6	8	47.1	2	25.0
A little	1	7.7	5	25.0	4	21.1	2	11.8	1	12.5
Not used	3	23.1	3	15.0	0	0.0	0	0.0	0	0.0
Don't know	2	15.4	3	15.0	2	10.5	1	5.9	0	0.0
Used other	0	0.0	2	10.0	0	0.0	0	0.0	0	0.0

In districts where mathematics and science curriculum revisions have been made since 1989, as school district size increases, an increasing percentage of superintendents reported that current recommendations in mathematics and science were used extensively or somewhat in the revision. This trend holds true in both mathematics and science and at all levels (elementary, middle school, and high school) for all districts, with the exception of those with enrollments of 400-599 students, where the percentages were considerably lower than those of any other group. This trend can be seen in Figures 5 and 6.

In examining the overall trends for incorporation of current reform recommendations in mathematics revisions, approximately 90 percent of superintendents in the largest districts (enrollments over 2500) reported that NCTM standards were used extensively or somewhat in revisions at all levels since 1989. This percentage falls to around 80 percent for districts of 1000-

TABLE 9

Use of AAAS/NSTA recommendations in school districts of various size that have revised their science curriculum since 1989 as reported by superintendents

Extent Used	Under 400 N	Under 400 %	400-599 N	400-599 %	600-999 N	600-999 %	1000-2500 N	1000-2500 %	Over 2500 N	Over 2500 %
Elementary										
Extensively	0	0.0	0	0.0	3	15.0	3	16.7	1	14.3
Somewhat	4	36.4	3	16.7	6	30.0	7	38.9	4	57.1
A little	3	27.3	2	11.1	4	20.0	3	16.7	0	0.0
Not used	4	36.4	3	16.7	3	15.0	0	0.0	0	0.0
Don't know	0	0.0	8	44.4	4	20.0	4	22.2	2	28.6
Used other	0	0.0	2	11.1	0	0.0	1	5.6	0	0.0
Middle/Junior High										
Extensively	0	0.0	0	0.0	3	14.3	3	16.7	1	16.7
Somewhat	4	36.4	3	15.0	6	28.6	7	38.9	4	66.7
A little	2	18.2	2	10.0	4	19.0	3	16.7	0	0.0
Not used	4	36.4	4	20.0	4	19.0	0	0.0	0	0.0
Don't know	1	9.1	9	45.0	4	19.0	4	22.2	1	16.7
Used other	0	0.0	2	10.0	0	0.0	1	5.6	0	0.0
High School										
Extensively	0	0.0	0	0.0	3	14.3	3	17.6	1	16.7
Somewhat	5	38.5	3	15.0	6	28.6	7	41.2	3	50.0
A little	2	15.4	2	10.0	4	19.0	2	11.8	0	0.0
Not used	5	38.5	4	20.0	2	19.0	0	0.0	0	0.0
Don't know	1	7.7	9	45.0	4	19.0	4	23.5	2	3.3
Used other	0	0.0	2	10.0	0	0.0	1	5.9	0	0.0

2500 and around 70 percent for districts enrolling 600-999. Only 35 percent of districts in the 400-599 range that have revised curricula in mathematics since 1989 reported that NCTM standards were used extensively or somewhat, while the percentage rose to 55-65 percent in districts of under 400 students.

In districts reporting science curriculum revisions at the elementary, middle school/junior high, and high school levels since 1989, the largest districts (over 2500) were more likely to report that AAAS/NSTA recommendations had been used extensively or somewhat in revisions at the three levels (67% to 83%). In districts of 1000-2500, between 55 and 60 percent of superintendents reported that the recommendations were used extensively or somewhat in the revisions at the three levels. In districts of 600-999 students, around 45 percent of the superintendents

Figure 5. Percent of superintendents in different size school districts reporting NCTM standards were used extensively or somewhat in district mathematics curriculum revisions made since 1989

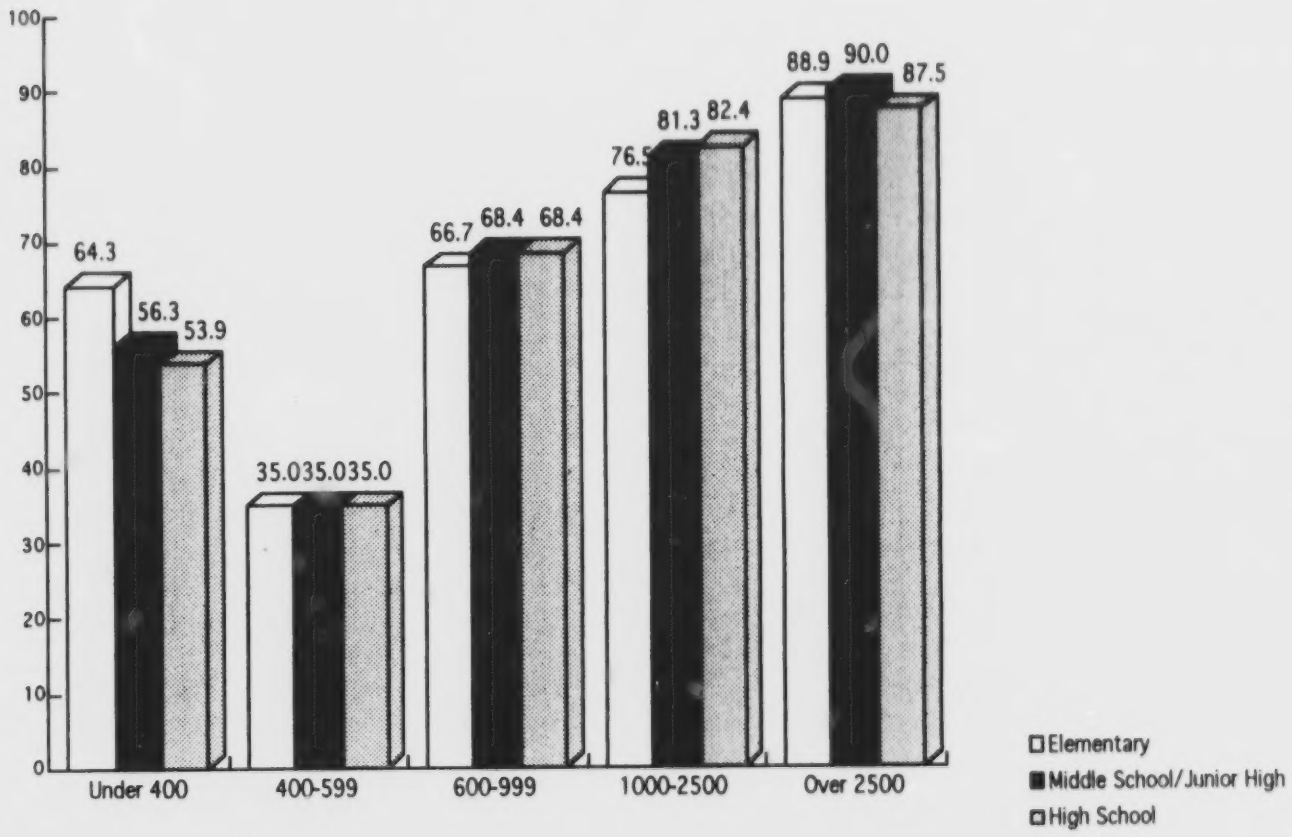
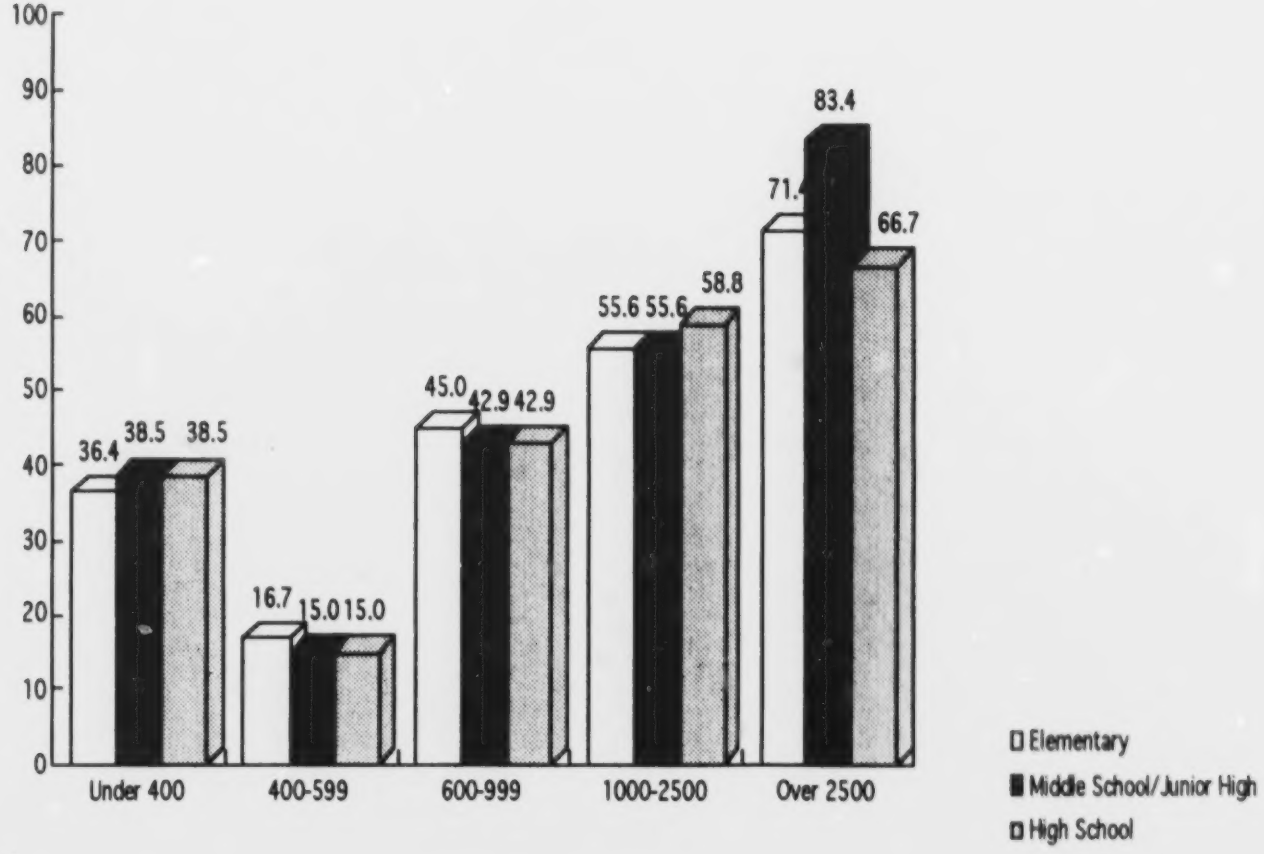


Figure 6. Percent of superintendents in different size school districts reporting AAAS/NSTA recommendations were used extensively or somewhat in district science curriculum revisions made since 1989



reported that the AAAS/NSTA recommendations had been used extensively or somewhat. The percentage using the recommendations drops dramatically in districts with 400-599 students to only around 15 percent for the three levels, and then rises again in the smallest districts (under 400) to between 35 and 40 percent.

Teacher Preparedness in Mathematics and Science

Overall, teachers felt that they were well prepared to implement new curriculum in the areas of mathematics and science. Figures 7, 8, and 9 provide information on ratings of teacher preparedness. Teachers in the smallest districts (under 400) rated the preparedness of middle school teachers in mathematics significantly higher than did teachers in the largest districts (over 2500). Teachers in the smallest districts (under 400) and in districts of 600-999 students rated the preparedness of teachers in science significantly higher than did teachers in districts of over 2500.

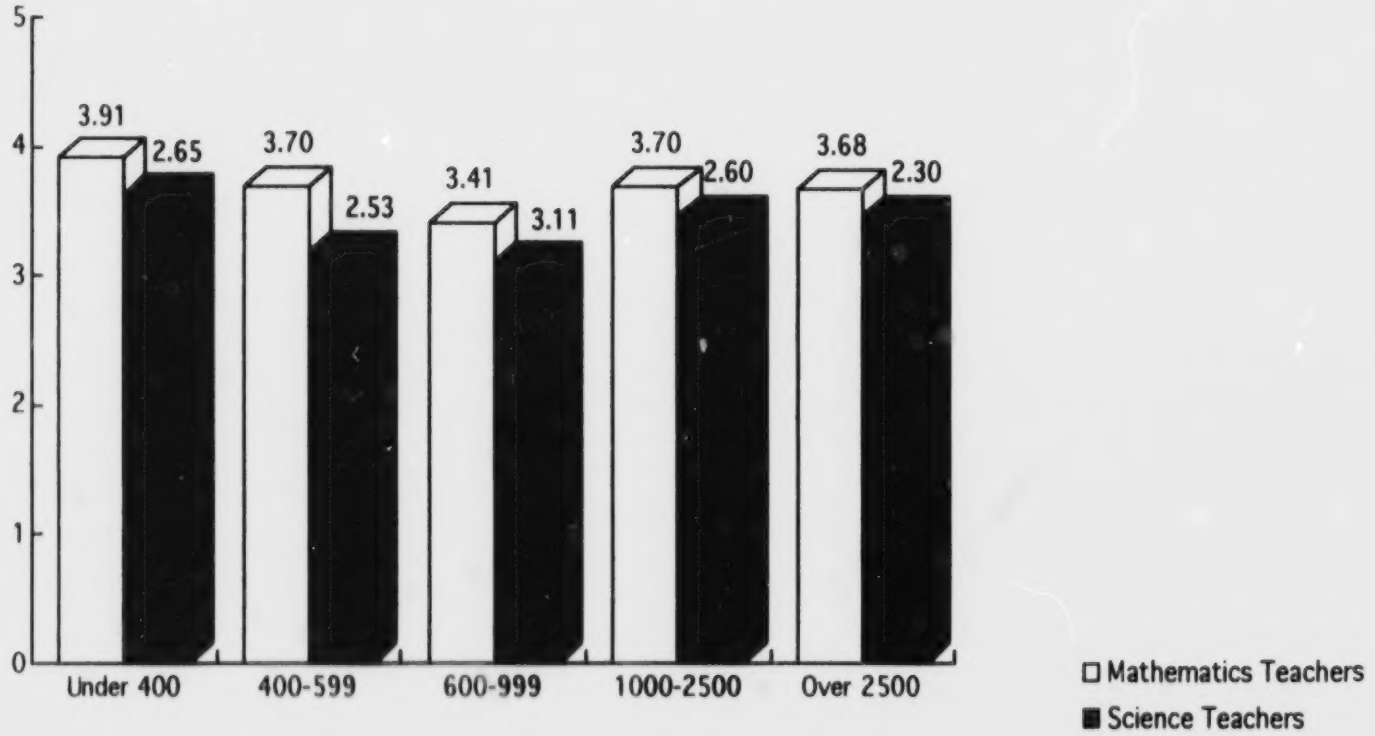
In districts with enrollments under 400, the average score for preparedness of middle school teachers to teach mathematics was 4.28, as compared to an average score of 3.77 by teachers in districts of over 2500. The teachers' rating for the preparedness of middle school teachers to teach science in school districts under 400 was 4.05, and the average rating in districts of 600-999 was 4.08. These were significantly higher than the 3.72 rating for middle school teacher preparedness in science by teachers in districts of over 2500.

In general, teachers at all levels (elementary, middle school/junior high, high school) rated the level of preparedness higher in mathematics than in science. The lowest overall rating for preparation (3.01) was given to elementary teachers in the area of science.

CONCLUSION

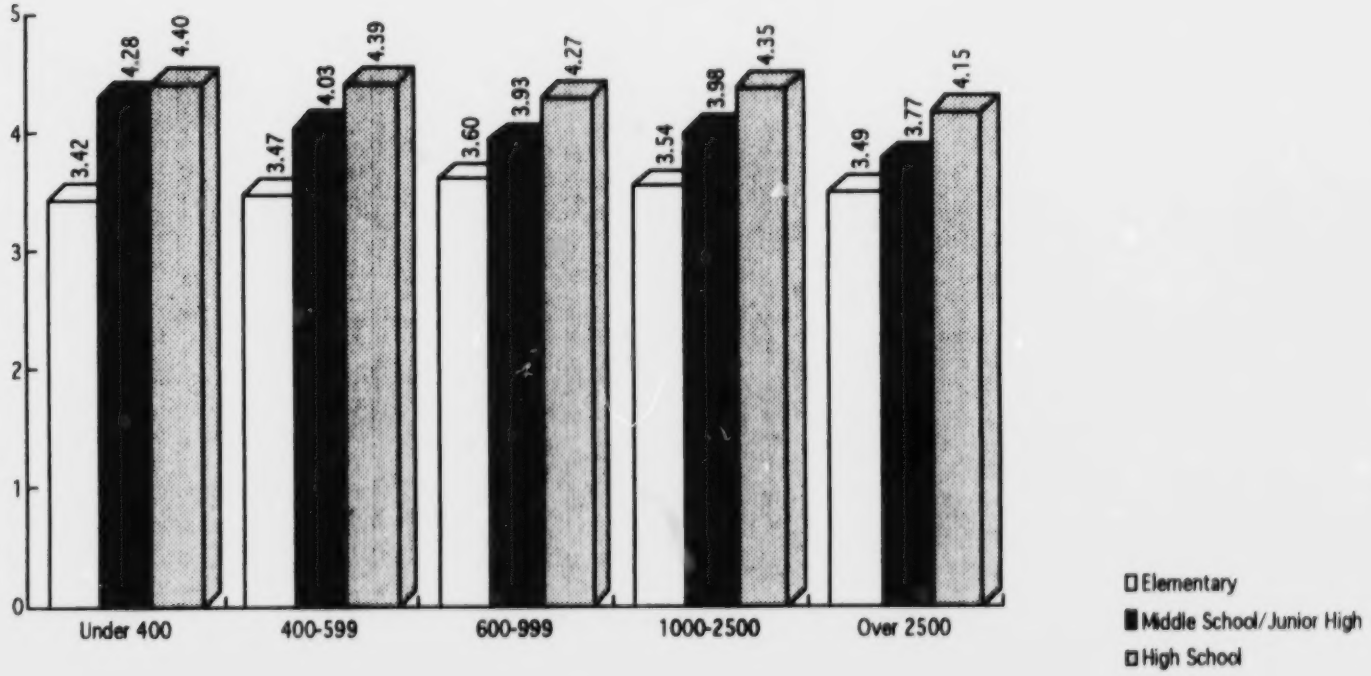
Some of the findings from this research are probably not surprising. Departmentalization of science and mathematics at the elementary level would probably be expected to occur more frequently in larger school districts. Teachers in smaller districts might have more control over the curriculum in their individual classes, while teachers in larger districts may be required to

Figure 7. Mathematics and science teacher perceptions of their preparedness to implement curriculum revisions by different size school districts



Scale: 1= Strongly Disagree 2= Disagree 3= No Opinion 4= Agree 5= Strongly Agree

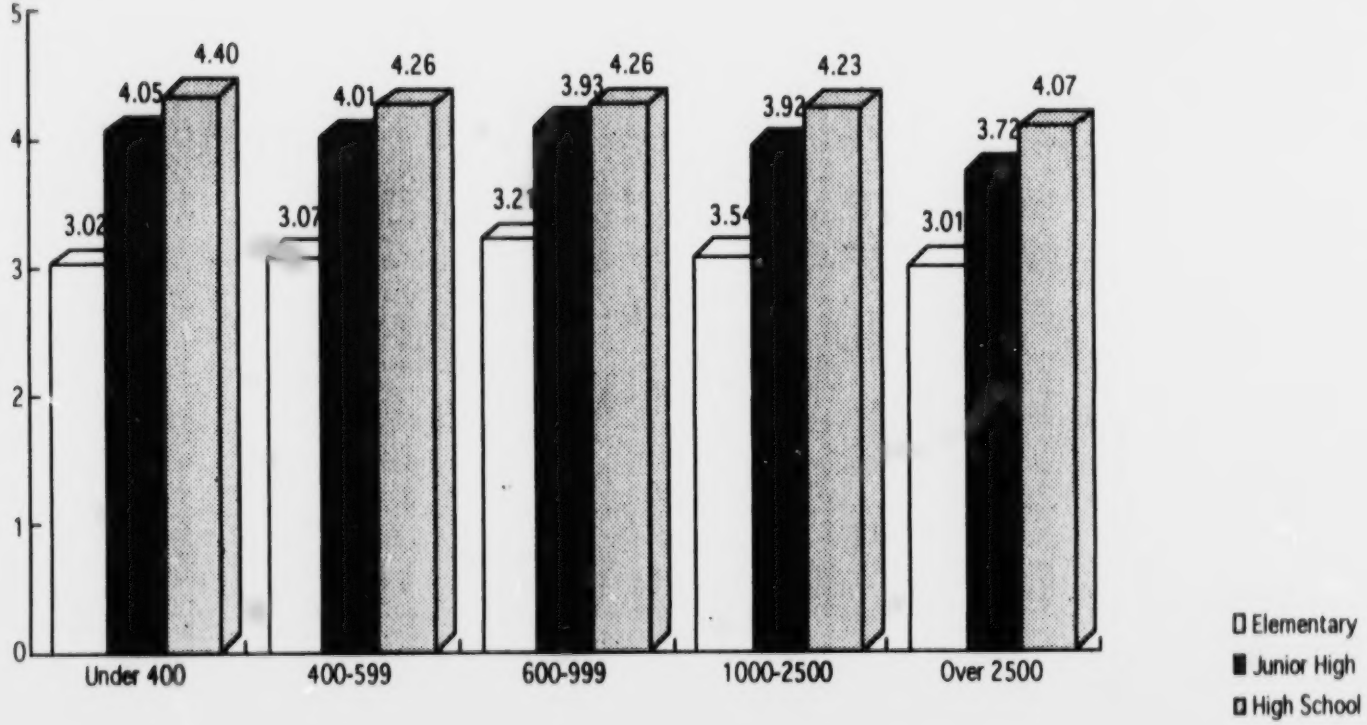
Figure 8. Mathematics and science teacher perceptions of the preparedness of district teachers to teach mathematics by different size school districts



Scale: 1= Strongly Disagree 2= Disagree 3= No Opinion 4= Agree 5= Strongly Agree

Note: Significant difference in perceptions about junior high teachers ($p<0.01$)

Figure 9. Mathematics and science teacher perceptions of the preparedness of district teachers to teach science by different size school districts



Scale: 1= Strongly Disagree 2= Disagree 3= No Opinion 4= Agree 5= Strongly Agree

Note: Significant difference in perceptions about junior high teachers ($p<0.01$).

adhere to district policy in order to maintain consistency across a larger population; it was, however, interesting to learn that some teachers considered adherence to the curriculum as voluntary, while none of the superintendents reported this.

What is most striking about the results of this study is the lack of significant differences among both teacher and superintendent groups from different size districts in knowledge of mathematics and science reform efforts. All groups reported little familiarity with reform efforts regardless of the size of the school district. It was somewhat surprising, however, to find that superintendents are somewhat more familiar with the reform efforts than are teachers of mathematics and science. Knowledge of reform efforts in mathematics was slightly higher for both superintendents and teachers than was knowledge about reform efforts in science. Teachers of both mathematics and science were more likely to know about reform recommendations for their own grade level than for other grade levels, although ratings for knowledge of reform efforts in their own areas were still low, ranging from 1.81 to 3.05 on a five-point scale.

The results show that there appears to be a lack of knowledge among both teachers and administrators about recent reform efforts in mathematics and science. Moreover, among the 65 to 75 percent of school superintendents reporting curriculum revisions since 1989, none in the smallest districts reported extensive use of science curriculum reform recommendations and few (5% to 15%) reported extensive incorporation of mathematics standards. This is, indeed, disheartening. More must be done to infuse curriculum reform into the curriculum in these schools.

Nevertheless, these findings can be viewed as an opportunity. Since between one-fourth and one-third of the superintendents reported that the next district curriculum revision would occur in the next two years and 35 to 40 percent report plans for curriculum revision in three to four years, these districts have the opportunity to incorporate current reform recommendations into their next revision of the curriculum. Now is an ideal time to introduce reform efforts to both teachers and superintendents in these schools, to provide educational opportunities to help them increase their level of knowledge about the standards and recommendations, and to

encourage utilization of NCTM standards and recommendations from AAAS and NSTA when revising district mathematics and science curricula.